



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL EXPOSURE RESEARCH LABORATORY  
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OFFICE OF  
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February 4, 2019

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**Subject:** NJ DEP Report #1: Targeted Analysis of PFCA in Soil Samples

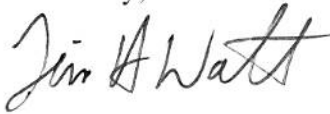
Dear Mr. Kloo:

I am pleased to provide you with this initial laboratory report of targeted analysis results for perfluorinated carboxylic acid (PFCA) concentrations in soils. This is the first in a series of reports prepared as a part of EPA Office of Research and Development's (ORD) collaboration with the New Jersey Department of Environmental Protection (NJ DEP) and EPA Region 2 on the study, "Detection, Evaluation, and Assignment of Multiple Poly- and Perfluoroalkyl Substances (PFAS) in Environmental Media from an Industrialized Area of New Jersey." This report includes concentration results for 13 PFCA in 24 soil samples. The ORD Principal Investigators (PIs) for this study are Drs. Andy Lindstrom, Mark Strynar, and John Washington. The results for this particular report were generated by Dr. John Washington in our Athens, Georgia laboratory. It is my understanding that these samples were collected by NJ DEP between October 23, 2017 and November 11, 2017 from various locations in the vicinity of the Solvay and Dupont facilities.

We do not interpret exposure or risk from the values presented in this report. EPA does not currently have health-based standards, toxicity factors, or associated risk levels for per- or poly-fluorinated alkyl substances (PFAS), other than perfluorooctanoic acid (PFOA) and perfluorocatane sulfonate (PFOS). While the data provided indicate the presence of certain PFCA in soil samples, it does not offer interpretation as to human or environmental exposure or risk.

Thank you for providing us with this opportunity for collaboration that helps to further both EPA's and New Jersey's understanding of an important public health issue. If you have any questions or concerns about this report, do not hesitate to contact me at (919) 541-2107 or via email at [watkins.tim@epa.gov](mailto:watkins.tim@epa.gov) or Tim Buckley at (919) 541-2454 or via email at [Buckley.timothy@epa.gov](mailto:Buckley.timothy@epa.gov). I look forward to our continued work together.

Sincerely,

A handwritten signature in black ink that reads "Tim H. Watkins". The signature is fluid and cursive, with the first name "Tim" and last name "Watkins" clearly legible.

Timothy H. Watkins  
Director  
National Exposure Research Laboratory  
Office of Research and Development

Enclosure

CC:

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## Detection, Evaluation, and Assignment of PFAS in Environmental Media from an Industrialized Area of New Jersey

### Laboratory Data Report #1: Targeted Analysis of PFCA in Soil

**Background.** EPA/ORD, EPA Region 2, and New Jersey Department of Environmental Protection (NJ DEP) worked together to develop a study to evaluate sources, as well as the nature and extent of PFAS contamination near manufacturing facilities in NJ. NJ DEP assumed responsibility for the collection of samples and their shipment to ORD laboratories. ORD was responsible for sample extraction and analysis. ORD personnel involved with laboratory analysis and their roles and responsibilities are provided below in Table 1.

**Table 1. EPA Office of Research and Development Analysis and Report Team.**

Responsibility	Personnel
ORD Principal Investigators	Andy Lindstrom, Mark Strynar, and John Washington
Laboratory Chemistry	John Washington (PI) and Tom Jenkins
Quality Assurance Review	Brittany Stuart, Sania Tong-Argao
Management Coordination and Review	Brian Schumacher, Adam Biales, Myriam Medina-Vera, Tim Buckley
Report Preparation	Kate Sullivan, Tim Buckley

This report includes results for 24 soil samples and 4 duplicates and field blanks collected by NJ DEP from November 8-10, 2017 and delivered to the ORD lab in Athens, GA on November 14, 2017. The results provided in this report were analyzed under the direction of Dr. John Washington. This report does not contain results for 5 soil core samples collected at the same time as analysis is not complete.

Thirteen perfluorinated carboxylic acid (PFCA) listed in Table 2 were analyzed with Ultra-Performance Liquid Chromatography Mass Spectrometry (UPLC-MS) using methods described within our Quality Assurance Project Plan (QAPP)<sup>1</sup> and that have been generally described in Rankin et al., 2015<sup>2</sup>. These analytes were selected because previous reports have shown them to be of concern. In brief, each sample was divided into three ~1 g aliquots. Each aliquot was extracted with 90%/10% acetonitrile water followed by a liquid/liquid cleanup. Samples were analyzed using a Waters Acquity UPLC coupled to a Waters Quattro Premier XE tandem mass spectrometer. The reported concentrations are determined as the mean value of triplicate aliquot analysis (Table 3). PFCA concentrations were determined using mass-labeled internal calibration curves for quantitation using a traditional targeted analysis approach. These analyses were performed on samples, process blanks, and check standards. Dilution of samples was not performed.

<sup>1</sup> National Exposure Research Laboratory, Quality Assurance Project Plan: Detection, Evaluation and Assignment of Multiple Poly and Per-fluoroalkyl Substances (PFAS) in environmental media from an industrialized area of New Jersey. Prepared for New Jersey Department of Environmental Protection (NJ DEP), September 14, 2017.

<sup>2</sup> K. Rankin, S. A. Maybury, T.M. Jenkins, J.W. Washington, A North American and global survey of perfluoroalkyl substances in surface soils: Distribution patterns and mode of occurrence. Chemosphere 161, 333-341 (2015).

**Table 2. PFCA Analyzed in NJ Soil Samples by UPLC-MS.**

Acronym	Chemical Name	Formula	CAS no.	Monoisotopic Mass (g/mol)
PFBA	Perfluorobutanoic Acid	C <sub>4</sub> HF <sub>7</sub> O <sub>2</sub>	375-22-4	213.9865
PFPeA	Perfluoropentanoic Acid	C <sub>5</sub> HF <sub>9</sub> O <sub>2</sub>	2706-90-3	263.9833
PFHxA	Perfluorohexanoic Acid	C <sub>6</sub> HF <sub>11</sub> O <sub>2</sub>	307-24-4	313.9801
PFHpA	Perfluoroheptanoic Acid	C <sub>7</sub> HF <sub>13</sub> O <sub>2</sub>	375-85-9	363.9769
PFOA	Perfluorooctanoic Acid	C <sub>8</sub> HF <sub>15</sub> O <sub>2</sub>	335-67-1	413.9737
PFNA	Perfluorononanoic Acid	C <sub>9</sub> HF <sub>17</sub> O <sub>2</sub>	375-95-1	463.9705
PFDA	Perfluorodecanoic Acid	C <sub>10</sub> HF <sub>19</sub> O <sub>2</sub>	335-76-2	513.9673
PFUnDA	Perfluoroundecanoic Acid	C <sub>11</sub> HF <sub>21</sub> O <sub>2</sub>	2058-94-8	563.9641
PRDoDA	Perfluorododecanoic Acid	C <sub>12</sub> HF <sub>23</sub> O <sub>2</sub>	307-55-1	613.9609
PFTTrDA	Perfluorotridecanoic Acid	C <sub>13</sub> HF <sub>25</sub> O <sub>2</sub>	72629-94-8	663.9577
PFTeDA	Perfluorotetradecanoic Acid	C <sub>14</sub> HF <sub>27</sub> O <sub>2</sub>	376-06-7	713.9545
PFHxDA	Perfluorohexadecanoic Acid	C <sub>16</sub> HF <sub>31</sub> O <sub>2</sub>	67905-19-5	813.9482
PFODA	Perfluorooctadecanoic Acid	C <sub>18</sub> HF <sub>35</sub> O <sub>2</sub>	16517-11-6	913.9418

### Quality Assurance

Data were checked for compliance with a number of laboratory and field related quality control evaluation criteria as specified in the project QAPP. Quality control results indicated that analyses were generally within expected performance criteria. Some individual analyte/sample values failed criteria and are flagged accordingly in Table 3.

### Results

Concentration results for 24 soil samples identified by sample IDs assigned by NJ DEP are presented in Table 3 along with 2 field duplicates and 2 field blanks. Results are reported for 13 PFCAs that range from C4 through C18. Soil sample and duplicate concentrations are reported as the mean of three sample aliquots in units of mass of PFCA per unit mass of dry solid, i.e., pg/g.

- Concentrations across all analytes and samples ranged from <LOD to values that exceeded our calibration curve. In general, lower concentrations were observed for C4-C8, C16, and C18 based on the number of values that were either <LOD or <LOQ. Across all samples, the highest concentrations were observed for C11 where two samples (PFSS001 and PFSS008) exceeded our calibration curve with estimated concentrations of 5,730 and 6,560 pg/g, respectively. These values are flagged accordingly with "JC1".
- Mid-carbon length compounds (PFOA, PFNA, PFDA, and PFUA) were consistently present in higher concentrations than other compounds, although concentrations were variable from site to site. The odd-chain lengths C9, C11, and C13 exceeded the one-carbon homologues, C8, C10 and C12, in numerous samples, a pattern that is unusual in our experience.

Table 3. PFCA Concentrations (pg/g) in Soil Samples Determined with Targeted Analysis.

Carbon Length	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C16	C18
NJDEP Sample ID	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUA	PFDoA	PFTrA	PFTeA	PFHxDA	PFODA
PFSS001	121 (U)	143	ND	91.4 (U)	398	2710	381	5730 (JC1)	99.4	590	24.7	ND	ND
PFSS002	102 (U)	52.2 (U)	ND	31.1 (U)	196 (JP)	91.2	115	1480	64.7	153	24.9	ND	ND
PFSS003	149	153	ND	159	422	770	581	1440.	244	252	104	ND	ND
PFSS004	ND	366 (U)	296 (U)	345	1070 (U)	2630 (JP)	625 (U)	2770 (JP)	183 (U)	326 (JP)	81.6 (U)	ND	ND
PFSS005	112 (U)	178	ND	132	244 (U)	691	231	825	60.9	85.6	28.0	ND	ND
PFSS006	119 (U)	245	ND	102	295 (U)	766	278	1370	111	165	46.5	ND	ND
PFSS007	257	276	186 (U)	188	749	1220	256	810	63.3	91.6	39.9	ND	ND
PFSS008	69.4 (U)	53.3	ND	37.7 (U)	ND	295	324	6560 (JC1)	277	1280	71.5	ND	ND
PFSS009	103	104	ND	91.2	162 (U)	522	207	1460	84.7	226	35.4	ND	ND
PFSS010	ND	77.7	158 (U)	151	1900	286	262	794	100	104	39.8	ND	ND
PFSS011	192	176 (U)	155 (U)	100	317	784	422	1370	117	166	54.9	ND	ND
PFSS012	88.8 (U)	171	ND	130	573	445	268	655	120	97.4	47.5	ND	ND
PFSS013	159	199	426 (U)	135	619	1150	312	1250	146	187	69.7	ND	ND
PFSS014	228 (JP)	192	228 (U)	139	415 (JP)	887 (JP)	337	803	103	97.9	36.9	ND	ND
PFSS015	153 (U)	213 (JP)	255 (U)	163 (JP)	599 (JP)	614 (JP)	473 (JP)	3970 (JP)	145 (JP)	347 (JP)	50.5 (JP)	ND	ND
PFSS016	91.4	213	268 (U)	172	264	651	296	307	74.1	54.3	31.5	ND	ND
PFSS017	141	295	320	319	405	711	1460	1160	448	134	114	39.0 (U)	ND
PFSS018	119 (U)	96.1	ND	66.3	160 (U)	356	364	377	113	65.1	45.0	ND	ND
PFSS019	143 (U)	150 (U)	ND	68.3 (U)	151 (U)	337 (U)	193	543	83.8	78.7	38.0	ND	ND
PFSS020	65.1 (U)	121	ND	56.4	92.7 (U)	475	192	1340	54.6	112	19.1	ND	ND
PFSS021	133 (U)	247	ND	176	689	626	401	895	150	129	71.2	ND	ND
PFSS022	760	622	ND	292	1250	658	697	1020	447	300	257	75.9 (U)	86.5 (JP)
PFSS023	283 (JP)	381	226 (U)	446	330 (U)	446	1060	1080	525	203	251	106 (U)	30.8 (U)
PFSS024	257	425	493 (U)	426	892	731	755	844	199	87.3	70.9	ND	ND
PFSSDUP1	152 (U)	535	526 (U)	509	804	862	765	858	193	90.5	70.8	ND	ND
PFSSDUP3	166	334	ND	94.2	185 (U)	846	241	1080	84.9	122	42.0	ND	ND
PFSSFB1	6.88 (U)	6.96 (U)	ND	ND	ND	7.94	ND	ND	1.81	ND	1.04 (U)	ND	ND
PFSSFB2	ND	ND	ND	7.52 (U)	ND	10.1	ND	1.25 (U)	13.7	ND	6.37	ND	ND
ND: Sample result is less than the limit of detection (<LOD).													
JP: Sample triplicates do not meet acceptance criteria for precision.													
U: Sample result is less than the limit of quantitation (<LOQ).													
JC1: Sample result exceeds the upper calibration range.													